

# PATENT ABSTRACTS OF JAPAN

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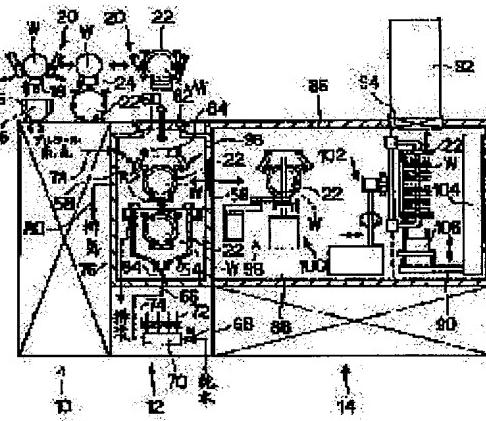
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## (54) SUBSTRATE PROCESSOR

### (57)Abstract:

**PURPOSE:** To prevent the adhesion of particles and the adsorption of a gas onto a substrate surface, and to obviate the deterioration of yield by averting the exposure of the substrate surface to the open air until a substrate is thermally treated after the period of the washing and drying processing of the substrate when the substrate is thermally treated.

**CONSTITUTION:** A washing and drying processing section 12 is connected continuously to a heat treatment section 14. The washing and drying processing section is constituted by surrounding a washing tank 54 by a sealed washing chamber 58 in a hermetically sealed warmer, and a substrate W washed and processed in the washing tank and pulled up from pure water is dried and processed by supplying the inside of the sealed washing chamber with the vapor of an organic solvent and decompressing the inside of the sealed washing chamber. The sealed washing chamber of the washing and drying processing section and the sealed chamber 86 of the heat treatment section are communicated and connected through a communicating opening with a freely openable and closing- able shutter 96, and the substrate is transferred between the sealed washing chamber and the sealed chamber 86.



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**CLAIMS**

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**[Claim(s)]****[Claim 1]A substrate processing device comprising:**

Where two or more substrates [ finishing / washing carried in in an airtight chamber and a drying process ] are accommodated in a boat for heat treatment, In a substrate processing device which carries in to an inside of a furnace body which was open for free passage via a substrate taking-out entrance provided with a building envelope and a shutter of said airtight chamber, and was made to perform necessary heat treatment to a substrate, So that sealing cleaning chambers which were open for free passage via a connection opening which equipped said airtight chamber with a building envelope and a shutter of the airtight chamber may be formed successively and a headroom may be exclusively surrounded at least by the sealing cleaning chambers, A cleaning tank with which two or more washing processings of a seed and last rinsing treatment are performed by accommodating alternatively a drug solution for washing and pure water replaceable, and immersing a substrate into the drug solution or pure water, respectively while having a liquid feed port for supplying a drug solution for washing and pure water at the pars basilaris ossis occipitalis is allocated, A substrate ascending and descending means to which an inside of said sealing cleaning chambers is made to carry out rise and fall movement of the substrate between an upper position of said cleaning tank, and a cleaning tank internal position while establishing a liquid supplying means which supplies alternatively a drug solution for washing, and pure water through said liquid feed port into the cleaning tank.

An exhaust means which makes a steam feeding mouth for supplying a steam of an organic solvent to the inside to said sealing cleaning chambers, and exhausts and decompresses inside of said sealing cleaning chambers to them, and a steam feeding means to supply a steam of an organic solvent through said steam feeding mouth into said sealing cleaning chambers.

A cassette which accommodated a substrate before washing in said sealing cleaning chambers is carried in, Automatic loader and unloaders with which taking out of a cassette which accommodated a substrate after heat treatment is performed are formed successively, A substrate before washing is transported into said sealing cleaning chambers from the automatic loader and unloader, The 1st substrate transporting means that transports a substrate after heat treatment to an automatic loader and unloader from the inside of sealing cleaning chambers, And the 2nd substrate transporting means that transports a substrate after washing and a drying process into said airtight chamber through said connection opening from the inside of said sealing cleaning chambers, and transports a substrate after heat treatment into sealing cleaning chambers through a connection opening from the inside of an airtight chamber.

**[Claim 2]A substrate processing device comprising:**

Where two or more substrates [ finishing / washing carried in in an airtight chamber and a drying process ] are accommodated in a boat for heat treatment, In a substrate processing device which carries in to an inside of a furnace body which was open for free passage via a substrate taking-out entrance provided with a building envelope and a shutter of said airtight chamber, and was made to perform necessary heat treatment to a substrate, So that sealing cleaning chambers which were open for free passage via a connection opening which equipped said

airtight chamber with a building envelope and a shutter of the airtight chamber may be formed successively and a headroom may be exclusively surrounded at least by the sealing cleaning chambers, A cleaning tank with which two or more washing processings of a seed and last rinsing treatment are performed by accommodating alternatively a drug solution for washing and pure water replaceable, and immersing a substrate into the drug solution or pure water, respectively while having a liquid feed port for supplying a drug solution for washing and pure water at the pars basilaris ossis occipitalis is allocated, A substrate ascending and descending means to which an inside of said sealing cleaning chambers is made to carry out rise and fall movement of the substrate between an upper position of said cleaning tank, and a cleaning tank internal position while establishing a liquid supplying means which supplies alternatively a drug solution for washing, and pure water through said liquid feed port into the cleaning tank.

An overheated steam blow-off part which makes said sealing cleaning chambers distribute overheated steam uniformly, and blows off horizontally to a headroom of said cleaning tank, and an overheated steam suction part which attracts overheated steam which blew off from an overheated steam blow-off part.

A cassette which accommodated a substrate before washing in said sealing cleaning chambers is carried in, Automatic loader and unloaders with which taking out of a cassette which accommodated a substrate after heat treatment is performed are formed successively, A substrate before washing is transported into said sealing cleaning chambers from the automatic loader and unloader, The 1st substrate transporting means that transports a substrate after heat treatment to an automatic loader and unloader from the inside of sealing cleaning chambers, And the 2nd substrate transporting means that transports a substrate after washing and a drying process into said airtight chamber through said connection opening from the inside of said sealing cleaning chambers, and transports a substrate after heat treatment into sealing cleaning chambers through a connection opening from the inside of an airtight chamber.

[Claim 3]A boat for heat treatment opens an interval in parallel mutually, and makes a circular board of a larger couple than a substrate counter, From one side which met the circular board in these both circular board, open two or more substrates of each other inserted so that insertion of a substrate was possible, respectively, and few [ in parallel ] intervals so that support is possible. The substrate processing device according to any one of claims 1 to 2 made into a common boat which it connects, two or more substrate support sticks are consisted of, and the boat for heat treatment uses also for washing and a drying process.

[Claim 4]Substrate alignment retention groove which makes the shape of a circle to which the 1st substrate transporting means met a plate surface of a plate, and a groove bottom side met a peripheral shape of a substrate Two or more. While opening an interval corresponding to a substrate support interval in a boat for heat treatment in parallel respectively mutually, making a longitudinal direction stand in a row and forming, Boat retention groove which makes the shape of a circle to which a groove bottom side met both sides of a sequence of two or more of these substrate alignment retention groove at a peripheral shape of a circular board of a boat for heat treatment, Open an interval corresponding to an interval of the circular boards of a couple in a boat for heat treatment in parallel respectively mutually, make substrate alignment retention groove stand in a row, and it forms, respectively, The substrate processing device according to claim 3 constituted by having a zipper which allocated in parallel holding fixture of each other rocked by rotating said rotation horizontal pivot in support of a cantilever type via a rotation horizontal pivot which met the longitudinal direction in the plate in a couple and the level surface.

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[Translation done.]

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

**[Industrial Application]**This invention relates to the substrate processing device which heat-treats oxidation, CVD, diffusion, etc. to various bases, such as a silicon wafer, a glass substrate, and electronic parts, in a semiconductor device manufacturing process, a liquid crystal display manufacturing process, an electronic-parts related manufacturing process, etc.

**[0002]**

**[Description of the Prior Art]**When oxidation treatment, CVD treatment, etc. heat-treated substrates, such as a silicon wafer, washing processing of a substrate was performed before the heat treatment, but the washing station of the substrate was conventionally installed in another area in a factory as a device completely different from the thermal treatment equipment of a substrate. And the substrate by which washing processing was carried out with various drug solutions in the washing station, and rinsing treatment was eventually carried out with pure water and by which the post-drying process was carried out, It paid out of the washing station under atmospheric air, and after that, by the robot, the conveying machine, or the operator, it was carried under atmospheric air from washing area in heat treatment area, and was carried in to the thermal treatment equipment.

**[0003]**Drawing 9 is a flat-surface layout pattern showing one example of the outline composition of the washing station of the conventional substrate, and a thermal treatment equipment. One or more which perform necessary washing processing to a substrate by the washing station's A accommodating the necessary drug solution for washing, and making a substrate immersed into the drug solution, One or more which the thing of the example of a graphic display accommodates [ one or more ] the three chemical washing tubs 1, 2, and 3 and pure water, make a substrate immersed into the pure water, and wash a substrate with pure water, The thing of the example of a graphic display forms successively the three pure-water-washing tubs 1, 2, and 3, the last rinse tub which carries out rinsing treatment of the substrate eventually using pure water, and the drying treatment parts which dry the surface of a substrate by which the last rinsing treatment was carried out, and adjoins the chemical washing tub 1, While forming the loader which lays the cassette which accommodated two or more substrates before washing, and has been carried in, The unloader which adjoins a drying treatment part and lays the cassette which accommodated the substrate which finished washing and a drying process and with which taking out of the cassette is performed is formed, It has a cassette track for transporting the substrate transfer robot which conveys the substrate between each [ of a loader, a chemical washing tub, a pure-water-washing tub, the last rinse tub a drying treatment part, and an unloader ], and an empty cassette to an unloader from a loader, etc., and is constituted. each chemical washing tub -- fluoric acid goes into the chemical washing tub 2, and the mixed solution of chloride and hydrogen peroxide solution is contained in the chemical washing tub 1 for the mixed solution of an ammonia solution and hydrogen peroxide solution at the chemical washing tub 3. As a drying process device of the substrate installed in a drying treatment part, The organic solvent vapor dryer dried by replacing the spin dryer which shakes off and dries pure water from the surface of a substrate according to a centrifugal force, and the pure water

adhering to the surface of the substrate with the steam of organic solvents, such as isopropyl alcohol, is used. The cassette which accommodated the washed substrate which an unloader is adjoined, and the stocker is provided and was taken out from the unloader can be stored temporarily, and the stocker can play the role like a buffer now. On the other hand, in order to prevent the influence of mixing of the air component inside [ heat treatment of a substrate is performed ] a furnace body, oxidation by the air component in the middle of a transfer of a substrate, etc., it connects with the taking-out entrance of a furnace body, and the load lock chamber is established in the thermal treatment equipment B. The automatic loader and unloader with which carrying in and taking out of a substrate are performed can be adjoined, the stocker can be provided, and the cassette which has been carried from the washing station part A and which accommodated the substrate can be temporarily stored now. And conveyance of the substrate to the thermal treatment equipment B will be performed under atmospheric air from the washing station A.

[0004]As a special example, as the outline flat-surface layout pattern of a device was conventionally shown in drawing 10, the washing station part C and the thermal-treatment-equipment part D might be made in-line with the interface robot E, and it might really constitute as a substrate processing device which can be performed from washing processing to heat treatment.

[0005]

[Problem(s) to be Solved by the Invention]As shown in drawing 9, when the washing station A and the thermal treatment equipment B are installed in respectively different area, In the washing station A, washing and the substrate which the drying process was carried out and was accommodated in the cassette, It pays out of the washing station A, is temporarily stored by the stocker, and is carried to heat treatment area from washing area, and while it is stored by the stocker of the thermal treatment equipment B and waiting for the turn of heat treatment, it will be put to the atmosphere by the surface. In the washing station A, the substrate was influenced by atmospheric the middle of between each tub being conveyed, and during the drying process in a drying treatment part.

[0006]As shown in drawing 10, in the substrate processing device which made in-line the washing station part C and the thermal-treatment-equipment part D with the interface robot E, the time which the substrate transportation between washing and a drying process, and a heat treatment process takes, and the waiting time to heat treatment can be suppressed to the minimum. However, while the interface robot is conveying the substrate accommodated in the cassette, a substrate will be influenced by atmospheric like the device which a substrate will be too put to the atmosphere and was shown in drawing 9 in the washing station part C.

[0007]As above, for this reason, influence of atmospheric on a substrate could not be eliminated, but adhesion of the particle to a substrate face and adsorption of gas took place, the contamination by carbon, a heavy metal, etc. occurred, and the oxide film was growing with the device of the conventional composition. As a result, the character of the film formed in the substrate face in the heat treatment process, for example, an oxidation process, and the CVD process worsens, and there is a problem that defects, such as IC, occur and the yield falls.

[0008]This invention is made in view of the above situations, and is a thing. Until the target substrate which finished washing and a drying process out of the period of washing and the drying process of a substrate performed as the head end process case is heat-treated, A substrate face is providing the substrate processing device which can eliminate the particle attachment and gas adsorption to a substrate face as cannot touch the atmosphere, and can prevent the fall of the yield by membrane contamination.

[0009]

[Means for Solving the Problem]A boat for heat treatment in which two or more substrates [ finishing / washing and a drying process ] were accommodated in this invention is carried in, To an airtight chamber to which a transfer of the boat for heat treatment is performed in order to carry in the carried-in boat for heat treatment into a furnace body. Sealing cleaning chambers which were open for free passage via a connection opening provided with a building envelope and

a shutter of the airtight chamber are formed successively, A cassette which accommodated a substrate before washing in the sealing cleaning chambers is carried in, and automatic loader and unloaders with which taking out of a cassette which accommodated a substrate after heat treatment is performed were formed successively. And a cleaning tank with which two or more washing processings of a seed and last rinsing treatment are performed by accommodating alternatively a drug solution for washing, and pure water replaceable, and immersing a substrate into the drug solution or pure water, respectively while having a liquid feed port for supplying a drug solution for washing, and pure water at the pars basilaris ossis occipitalis. It allocates so that the headroom may be exclusively surrounded by said sealing cleaning chambers at least, A liquid supplying means which supplies alternatively a drug solution for washing and pure water through said liquid feed port into the cleaning tank, and a substrate ascending and descending means to which rise and fall movement of the substrate is carried out between an upper position of said cleaning tank and a cleaning tank internal position in an inside of sealing cleaning chambers were established, respectively. A steam feeding mouth for supplying a steam of an organic solvent to the inside at said sealing cleaning chambers is made as the 1st composition, Form an exhaust means which exhausts and decompresses inside of said sealing cleaning chambers, and a steam feeding means to supply a steam of an organic solvent through said steam feeding mouth into said sealing cleaning chambers, respectively, and as the 2nd composition, An overheated steam blow-off part which makes said sealing cleaning chambers distribute overheated steam uniformly, and blows off horizontally to a headroom of said cleaning tank, and an overheated steam suction part which attracts overheated steam which blew off from an overheated steam blow-off part were provided. A substrate before washing is transported into said sealing cleaning chambers from said automatic loader and unloader, The 1st substrate transporting means that transports a substrate after heat treatment to an automatic loader and unloader from the inside of sealing cleaning chambers, And the 2nd substrate transporting means that transports a substrate after washing and a drying process into said airtight chamber through said connection opening from the inside of said sealing cleaning chambers, and transports a substrate after heat treatment into sealing cleaning chambers through a connection opening from the inside of an airtight chamber was established, respectively.

[0010]Open an interval in parallel mutually and a boat for heat treatment is made for a circular board of a larger couple than a substrate to counter, From one side which met the circular board in these both circular board, open two or more substrates of each other inserted so that insertion of a substrate was possible, respectively, and few [ in parallel ] intervals so that support is possible. It can connect, can constitute from two or more substrate support sticks, and can be considered as a common boat which uses the boat for heat treatment also for washing and a drying process. Substrate alignment retention groove which makes the shape of a circle to which a groove bottom side met a plate surface of a plate in the 1st above-mentioned substrate transporting means at a peripheral shape of a substrate Two or more [ in this case, ]. While opening an interval corresponding to a substrate support interval in a boat for heat treatment in parallel respectively mutually, making a longitudinal direction stand in a row and forming, Boat retention groove which makes the shape of a circle to which a groove bottom side met both sides of a sequence of two or more of these substrate alignment retention groove at a peripheral shape of a circular board of a boat for heat treatment, Open an interval corresponding to an interval of the circular boards of a couple in a boat for heat treatment in parallel respectively mutually, make substrate alignment retention groove stand in a row, and it forms, respectively, A zipper which allocated in parallel holding fixture of each other rocked by rotating said rotation horizontal pivot in support of a cantilever type via a rotation horizontal pivot which met the longitudinal direction in the plate in a couple and the level surface can be had and constituted.

[0011]

[Function]In the substrate processing device of composition of having described above, from washing processing of two or more sorts of substrates to the last rinsing treatment is performed by sealing cleaning chambers in the cleaning tank with which the headroom was surrounded

exclusively, [ can pull up the substrate by which the last rinsing treatment was carried out in the cleaning tank out of the pure water in a cleaning tank, and / as it is / in sealing cleaning chambers ], A drying process is carried out by [ the steam of an organic solvent is supplied in the sealing cleaning chambers, and the inside of sealing cleaning chambers is decompressed ] depending especially or supplying overheated steam in sealing cleaning chambers. Therefore, a substrate does not touch the atmosphere at all until a drying process is completed from washing processing. And although washing and the substrate by which the drying process was carried out are transported into an airtight chamber from the inside of sealing cleaning chambers by a substrate transporting means, and it is carried in to the inside of a furnace body and is heat-treated, Sealing cleaning chambers and an airtight chamber are open for free passage, and a transfer of the substrate into [ out of sealing cleaning chambers ] an airtight chamber is performed through the connection opening provided with the shutter. For this reason, without touching the atmosphere, it will be transported into an airtight chamber and the substrate which finished washing and a drying process will be heat-treated. Thus, since the substrate face cannot touch the atmosphere at all until the substrate which finished washing and a drying process out of the period of washing and the drying process of a substrate is heat-treated, the particle attachment or gas adsorption to a substrate face do not happen, and are not influenced at all by atmospheric.

[0012]

[Example]It explains referring to drawings for the suitable example of this invention hereafter.

[0013]Drawing 1 is transverse-plane drawing of longitudinal section showing the outline composition of the substrate processing device concerning one example of this invention. Drawing 2 is the flat-surface cross-sectional view.

This substrate processing device comprises an automatic loader and unloader and the substrate transfer part 10, washing and a drying treatment part 12, and the heat treatment part 14.

They are unified.

And from washing of a substrate to heat treatment will be performed by this substrate processing device.

[0014]In an automatic loader and unloader and the substrate transfer part 10. The turntable which rotates 90 degrees of cassettes 16 which accommodated the substrate before processing and have been carried in and into which the direction is changed although the detailed mechanism is not illustrated, Two or more parallel retention groove for holding two or more substrates by a vertical attitude has the substrate retainer board 18 formed in the upper surface, Two or more substrates W before processing are collectively extracted upwards from the cassette 16 laid on the turntable, The 1st substrate lift style that two or more substrates after processing are dropped, and is put in block and inserted into the cassette 16, Have the zipper 20 mentioned later and the substrate W is transported between the taking-out ON position of the cassette 16, and a substrate moving position, The substrate and common boat transfer robot which transports the common boat 22 by which two or more substrates W were inserted between a substrate moving position, and washing and a drying treatment part 12, Two or more parallel retention groove for holding two or more substrates by a vertical attitude has the substrate retainer board 24 formed in the upper surface, The 2nd substrate lift style that bundles up, and inserts into the common boat 22 which dropped two or more substrates W before processing, and was placed by the substrate moving position, and extracts two or more substrates after processing collectively from the common boat 22. The common boat is established in the boat rising and falling mechanism etc. which can go up and down to a tie-in point with a substrate common boat transfer robot.

[0015]As shown in drawing 4, open and the common boat 22 makes the circular boards 26 and 26 of a larger couple than the substrate W an interval counter in parallel mutually, it connects these both the circular boards 26 and 26, and two or more and the example of a graphic display constitute them from the four substrate support sticks 28. As the both ends of each substrate support stick 28 adhere to the edge part of each circular board 26, respectively and the four substrate support sticks 28 adhere to the semicircle portion of the circular board 26, the substrate W can be inserted from one way which met the circular board 26. Two or more

substrate support slots 30 for opening and supporting few [ in parallel ] intervals mutually, respectively are formed in each substrate support stick 28 in two or more substrates W. The hook nails 32 and 32 of the couple for hanging the common boat 22 of a horizontal position have adhered to both the circular board 26, respectively. This common boat 22 is formed, for example at the charge of a quartz material, accommodates two or more substrates W, and is used for both washing and a drying process process, and a heat treatment process.

[0016]As shown in drawing 3 and drawing 4, in a couple and the level surface, the zipper 20 of a substrate and a common boat transfer robot allocates in parallel the holding fixture 34 of each other which supports a plate at a cantilever ceremony via the rotation horizontal pivot 36 in alignment with the longitudinal direction, and is constituted. The holding fixture 34 of the couple is supported at the circumference of a horizontal axis, enabling free rocking.

By rotating the rotation horizontal pivot 36 with the drive mechanism (not shown) connected with the rotation horizontal pivot 36, it rocks symmetrically mutually.

The substrate alignment retention groove 38 which makes the shape of a circle to which the groove bottom side met the one side side which countered each holding fixture 34 at the peripheral shape of the substrate W, respectively in parallel respectively mutually two or more at intervals of the substrate support slot 30 of the substrate support stick 28 of the common boat 22, and an identical pitch, While being stood in a row and formed in the longitudinal direction, are the both sides of the sequence of two or more of these substrate alignment retention groove 38, and to the both ends in a longitudinal direction. The boat retention groove 40 of the couple which makes the shape of a circle to which the groove bottom side met the peripheral shape of the circular board 26 of the common boat 22 opens the interval corresponding to the distance between the circular boards 26 and 26 of the couple of the common boat 22 in parallel respectively mutually, and is formed. And reciprocation moving of the zipper 20 is made respectively free between a cassette taking-out ON position and substrate moving positions and in between a substrate moving position, and washing and drying treatment parts 12.

[0017]In transporting the substrate W between a cassette taking-out ON position and a substrate moving position with the substrate and common boat transfer robot having the zipper 20 constituted as mentioned above, As the partial expanded sectional view which cut at (c) the sectional view which cut the perspective view at (b) in the direction which intersects perpendicularly with the longitudinal direction of the holding fixture 34 along with the longitudinal direction of the holding fixture 34 to (a) of drawing 3 was shown, respectively, Two or more substrates W are collectively held with the holding fixture 34 of the couple of the zipper 20 so that a part of edge part of each substrate W may be inserted, respectively into each substrate alignment retention groove 38 of the holding fixture 34 of the couple of the zipper 20. On the other hand, in transporting the substrate W between a substrate moving position, and washing and a drying treatment part 12 with a substrate and a common boat transfer robot, As the partial expanded sectional view which cut at (c) the sectional view which cut the perspective view at (b) in the direction which intersects perpendicularly with the longitudinal direction of the holding fixture 34 along with the longitudinal direction of the holding fixture 34 to (a) of drawing 4 was shown, respectively, The common boat 22 is held with the holding fixture 34 of the couple of the zipper 20 so that a part of edge part of each circular board 26 of the common boat 22 which accommodated two or more substrates W in each boat retention groove 40 of the holding fixture 34 of the couple of the zipper 20 may be inserted, respectively.

[0018]As shown in drawing 5, each ends of the both ends of the rod-like structures 44 and 44 of a parallel couple are mutually connected with the end plate 46, respectively, On the other hand, the rod-like structures 44 and 44 of a couple Or the whole or both part of the direction of a peripheral surface. While arranging in parallel and forming the substrate alignment retention groove 48 in an axial direction in the example of a graphic display at intervals of the substrate support slot 30 of the substrate support stick 28 of two or more and the common boat 22, and an identical pitch in the whole direction of a peripheral surface of both rod-like structures 44, The interval corresponding to the distance between the circular boards 26 and 26 of the couple of the common boat 22 for the boat retention groove 50 is opened and formed in the both ends of the rod-like structure 44, The zipper of a substrate and a common boat transfer robot can

also be constituted for the holding fixture 42 which adhered the rotation horizontal pivot 52 to one side of the end plate 46 a couple and by allocating in parallel mutually. These zippers form the same slot as an opposite hand, and they are constituted so that before washing and the washing back may be properly used for a substrate and a boat to each and cross contamination may be prevented.

[0019]Washing and the drying treatment part 12 have the overflow liquid holder part 56 provided in the cleaning tank 54 and the upper part periphery of this cleaning tank 54.

It is constituted so that these whole may be surrounded by the sealing cleaning chambers 58. The opening 60 for carrying out taking-out ON of the substrate W is made by the upper part of the airtight chamber 16.

The opening and closing cover 62 which seals the opening 60 enabling free opening and closing is formed.

The liquid feed port 64 is made by the cleaning tank 54 at the pars basilaris ossis occipitalis. Free passage connection of the liquid feed port 64 is made by the feed line 66 at the pure water supply source.

While the opening and closing valve 68 is inserted in the feed line 66, the mixing valve 70 is inserted in the channel between the opening and closing valve 68 and liquid feed port 64 of the cleaning tank 54. Free passage connection of two or more chemical supply pipe ways 72 where channel connection was made, respectively and the opening and closing valve 74 was inserted in the supply source of the drug solution for washing of a kind different, respectively is made at the mixing valve 70. And by opening the opening and closing valve 68 inserted in the feed line 66 while opening only one of the opening and closing valves 74 inserted in the chemical supply pipe way 72, Any one kind of drug solution for washing is mixed by the pure water supplied from a pure water supply source, the necessary treating solution for washing is prepared, and the treating solution for washing is supplied into the cleaning tank 54 through the liquid feed port 64 through the feed line 66. While blockading altogether the opening and closing valve 74 inserted in the chemical supply pipe way 72, pure water is supplied into the cleaning tank 54 through the feed line 66 from a pure water supply source by opening the opening and closing valve 68 inserted in the feed line 66. The drainage-tube way 76 is connected to the overflow liquid holder part 56. And in the cleaning tank 54, by supplying the treating solution for washing into a tub continuously through the liquid feed port 64, and making the overflow section of the tub upper part overflow a treating solution, the rise liquid flow of a treating solution is formed in the inside of a tub, and washing processing of the substrate W is carried out by placing the substrate W into the rise liquid flow of the treating solution.

[0020]The steam feeding mouth for supplying the steam of an organic solvent, for example, the steam of isopropyl alcohol, into the sealing cleaning chambers 58 is made by the sealing cleaning chambers 58.

Channel connection of the alcohol vapor supply source is made via the pipeline 78 for steam feeding at the steam feeding mouth.

Although not illustrated to drawing 1, while channel connection is made and alcohol vapor is fed by the nitrogen supply source into the sealing cleaning chambers 58 by making nitrogen gas into carrier gas, the pipeline 78 for steam feeding, It has composition which can send in only nitrogen gas into the sealing cleaning chambers 58 through the pipeline 78 for steam feeding by the change of a channel, and can purge the inside of the sealing cleaning chambers 58. The exhaust port is made by the sealing cleaning chambers 58, and an exhaust port via the exhaust pipe way 80 An exhaust means, For example, channel connection is made at the water seal type vacuum pump, and the inside of the sealing cleaning chambers 58 can be decompressed by exhausting the inside of the sealing cleaning chambers 58 with a vacuum pump through the exhaust port. Although the graphic display is omitted, the substrate lift style which makes the attaching part 82 hold and go up and down the common boat 22 is provided in the inside of the sealing cleaning chambers 58.

By this substrate lift style, rise and fall movement of the substrate W accommodated in the common boat 22 can be carried out now between the upper position of the cleaning tank 54, and cleaning tank 54 internal position.

Inside the sealing cleaning chambers 58, the common boat transfer robot 84 which receives the common boat 22 from the zipper 20 of a substrate and a common boat transfer robot, and is transferred to the attaching part 82 of a substrate lift style is allocated.

[0021]On the other hand, it has the airtight chamber 86, the inside of the airtight chamber 86 is divided into the load-locks preparation room 88 and the load lock chamber 90, and the heat treatment part 14 is making free passage connection with the furnace body 92 via the substrate taking-out entrance provided with the shutter 94 which the load lock chamber 90 can open and close freely. And the load-locks preparation room 88 and the sealing cleaning chambers 58 of washing and the drying treatment part 12 are making free passage connection airtightly via the connection opening provided with the shutter 96 which can be opened and closed freely. The common boat transfer robot 98 is allocated in the load-locks preparation room 88.

With this common boat transfer robot 98, the common boat 22 in which two or more substrates W which finished the last rinse and a drying process were accommodated is transported into the load-locks preparation room 88 through a connection opening from the inside of the sealing cleaning chambers 58 by washing and the drying treatment part 12.

The mounting stages 100 are allocated in the load-locks preparation room 88 temporarily receives the common boat 22 from the common boat transfer robot 98, and lay the common boat 22 temporarily. The common boat transfer robot 102 is formed in the load-locks preparation room 88.

With this common boat transfer robot 102, the common boat 22 in which the substrate W was accommodated is moved to up to the common boat support and sealing lid 106 held in the elevator 104 allocated in the load lock chamber 90 enabling free rise and fall.

And the elevator 104 takes out the substrate after inserting the substrate W accommodated in the common boat 22 supported on the common boat support and sealing lid 106 into the furnace body 92 through the substrate taking-out entrance and carrying out heat treatment of necessary, for example, decompression CVD treatment, within the furnace body 92 out of the furnace body 92. The exhaust port is made by the airtight chamber 86.

Channel connection is made at the exhaust means, for example, a vacuum pump, and the exhaust port can decompress the inside of the airtight chamber 86 by exhausting the inside of the airtight chamber 86 with a vacuum pump through the exhaust port.

Although the illustrated furnace body 92 is a vertical mold type, a horizontal-type type furnace body may be sufficient. Purge timing can be shortened by dividing the load-locks preparation room 88 and the load lock chamber 90 with another shutter, in order to gather processing speed, and exhausting by a respectively different exhaust means.

[0022]Next, it explains, referring to the flow chart shown in drawing 6 and drawing 7 for a series of processes of performing from washing and the drying process of a substrate to heat treatment using the substrate processing device of composition of having described above.

[0023]When the cassette 16 which accommodated two or more substrates W before processing is carried in and laid in an automatic loader and unloader and the substrate transfer part 10, by the 1st substrate lift style. From the cassette 16, it is collectively extracted upwards by the substrate W and two or more of these substrates W. After it is grasped by the zipper 20 of a substrate and a common boat transfer robot and being transported to a substrate moving position by a substrate and the common boat transfer robot, it is collectively inserted by the 2nd substrate lift style into the common boat 22 placed by the substrate moving position. If the substrate W is accommodated in the common boat 22, after being transported to washing and the drying treatment part 12 and opening the opening and closing cover 62 of the sealing cleaning chambers 58 wide, the common boat 22 will be carried in into the sealing cleaning chambers 58 through the opening 60, and will be transferred to the attaching part 82 of a substrate lift style. and evacuation of the inside of the sealing cleaning chambers 58 being carried out by a vacuum pump, and a decompression purge being carried out or, if the opening and closing cover 62 is closed and the inside of the sealing cleaning chambers 58 is sealed, Nitrogen gas is sent in through the pipeline 78 for steam feeding into the sealing cleaning chambers 58, and the gas purge of the inside of the sealing cleaning chambers 58 is carried out. At this time, the treating solution which the necessary treating solution for washing was

continuously supplied through the liquid feed port 64 of that pars basilaris ossis occipitalis in the cleaning tank 54, and filled cleaning tank 54 inside overflows from the overflow section of that upper part, and flows into the overflow liquid holder part 56, and the effluent is carried out through the drainage-tube way 76 from the overflow liquid holder part 56.

The rise liquid flow of the treating solution is formed in the inside of the cleaning tank 54. Next, the substrate lift style operates and the common boat 22 held at the attaching part 82 descends, Necessary washing processing is performed to the substrate W by making the substrate W accommodated in the common boat 22 immerse into the treating solution in the cleaning tank 54, and placing the substrate W into the rise liquid flow of the treating solution in the cleaning tank 54. And by changing the kind of treating solution for washing supplied into the cleaning tank 54, having arranged the substrate W in the cleaning tank 54, two or more sorts of washing processings are performed to the substrate W, and rinsing treatment is eventually performed to the substrate W with pure water. The substrate W by which rinsing treatment was carried out eventually is raised by the substrate lift style, and can be pulled up out of the pure water in the cleaning tank 54. And at the same time as the substrate W can begin to pull up out of pure water, alcohol vapor is sent in from a steam feeding mouth into the sealing cleaning chambers 58 through the pipeline 78 for steam feeding, and alcohol vapor is supplied to the circumference of the substrate W in the middle of the ability to pull up out of pure water. Supply of this alcohol vapor is performed until raising of the substrate W out of pure water is completed thoroughly at least. After raising of the substrate W out of pure water is completed, supply of the pure water into the cleaning tank 54 is stopped, and the pure water in the cleaning tank 54 is discharged simultaneously. At the same time as it begins to discharge pure water from the cleaning tank 54, by carrying out evacuation of the inside of the sealing cleaning chambers 58 by a vacuum pump, and making the inside of the sealing cleaning chambers 58 into a reduced pressure state, the alcohol which was condensed on the surface of the substrate W and was replaced by pure water is evaporated, and the drying process of the substrate W is completed. [0024]As mentioned above, in washing and the drying treatment part 12 the substrate W. Since washing processing is carried out, it is processed in the sealed sealing cleaning chambers 58 and the atmosphere is not touched at all after the last rinsing treatment is carried out until a drying process is completed, particle does not adhere to the surface of the substrate W between them, or gas, such as carbon dioxide and oxygen, does not adsorb.

[0025]After the drying process of the substrate W in washing and the drying treatment part 12 is completed, the shutter 96 of a connection opening is opened wide and the common boat 22 in which two or more substrates W were accommodated is transported by the common boat transfer robot 98 into the load-locks preparation room 88 through a connection opening from the inside of the sealing cleaning chambers 58. Before transporting the common boat 22 into the load-locks preparation room 88 from the inside of the sealing cleaning chambers 58 if needed at this time, where the shutter 96 of a connection opening is blockaded, Evacuation of the inside of the airtight chamber 86 of the heat treatment part 14 is carried out, and the inside of the load lock chamber 90 and the load-locks preparation room 88 is decompressed until it becomes the same pressure as the inside of the sealing cleaning chambers 58 of washing and the drying treatment part 12. After purging the inside of the sealing cleaning chambers 58 with nitrogen gas after the drying process of the substrate W in washing and the drying treatment part 12 is completed, and returning the inside of the sealing cleaning chambers 58 from under decompression to under atmospheric pressure, it may be made to transport the substrate W into the load-locks preparation room 88 of the heat treatment part 14. In this case, instead of carrying out evacuation of the inside of the airtight chamber 86 of the heat treatment part 14, and decompressing the inside of the load lock chamber 90 and the load-locks preparation room 88, Where it forms a means to supply nitrogen gas, into the airtight chamber 86 and the shutter 96 of a connection opening is blockaded, After sending in nitrogen gas into the airtight chamber 86 of the heat treatment part 14 and purging the inside of the airtight chamber 86, the shutter 96 of a connection opening is opened wide, The common boat 22 in which the substrate W was accommodated is transported into the load-locks preparation room 88 from the inside of the sealing cleaning chambers 58 of washing and the drying treatment part 12.

[0026]When the common boat 22 in which two or more substrates W were accommodated is transported into the load-locks preparation room 88, the shutter 96 of a connection opening is blockaded. Next, from the common boat transfer robot 98, the common boat 22 is transferred to the mounting stages 100 temporarily, and ranks second, By the common boat transfer robot 102, the common boat 22 in which the substrate W was accommodated is moved to the elevator 104 on the common boat support and sealing lid 106 held enabling free rise and fall. [ this the operation of a series of ], a decompression purge or the nitrogen gas purge of the inside of the load lock chamber 90 is carried out, and it is adjusted so that the inside of the load lock chamber 90 may become the same pressure as the internal pressure of the furnace body 92. When the inside of the load lock chamber 90 becomes the same pressure as the internal pressure of the furnace body 92, it is wide opened by the shutter 94 of the substrate taking-out entrance of the furnace body 92, and in the elevator 104. The substrate W accommodated in the common boat 22 supported on the common boat support and sealing lid 106 is carried in into the furnace body 92 through a substrate taking-out entrance. If the substrate W is carried in into the furnace body 92, the shutter 94 of the substrate taking-out entrance of the furnace body 92 will be blockaded, and necessary heat treatment, for example, decompression CVD treatment, will be performed to the substrate W in the furnace body 92.

[0027]As mentioned above, the substrate W by which washing and the last rinsing treatment were carried out, and the drying process was carried out in washing and the drying treatment part 12 in this substrate processing device. Since it is transported into the load-locks preparation room 88 of the heat treatment part 14, without touching the atmosphere, particle does not adhere to a substrate face between the transfer, or gas, such as carbon dioxide and oxygen, does not adsorb.

[0028]After heat treatment of the substrate in the furnace body 92 is completed, the shutter 94 of the substrate taking-out entrance of the furnace body 92 is opened wide again, The elevator 104 drives and the substrate which was accommodated in the common boat 22 supported on the common boat support and sealing lid 106, and finished heat treatment is taken out through a substrate taking-out entrance from the inside of the furnace body 92. After taking out of the substrate out of the furnace body 92 finishes, the shutter 94 of the substrate taking-out entrance of the furnace body 92 is blockaded again. Then, the common boat 22 in which the substrate after heat treatment was accommodated, With the common boat transfer robot 102, from on the common boat support and sealing lid 106, it is transferred to up to the mounting stages 100 temporarily, and ranks second, It is moved to the common boat transfer robot 98, and pressure up of the inside of the load lock chamber 90 and the load-locks preparation room 88 is carried out [ this operation ], or a nitrogen gas purge is carried out. And it is wide opened by the shutter 96 of a connection opening and with the common boat transfer robot 98. The common boat 22 in which two or more substrates W after heat treatment were accommodated is transported into the sealing cleaning chambers 58 through a connection opening from the inside of the load-locks preparation room 88, and the shutter 96 of a connection opening is blockaded after that. If the shutter 96 of a connection opening is blockaded, pressure up of the inside of the sealing cleaning chambers 58 will be carried out, or a nitrogen gas purge will be carried out, and the inside of the sealing cleaning chambers 58 will return to atmospheric pressure. If the inside of the sealing cleaning chambers 58 returns to atmospheric pressure, the opening and closing cover 62 will be opened wide, and the common boat 22 will be taken out through the opening 60 from the inside of the sealing cleaning chambers 58. If the common boat 22 is taken out from the inside of the sealing cleaning chambers 58, the common boat 22 will be transported to a substrate moving position by a substrate and the common boat transfer robot, and the substrate W will bundle it up from the common boat 22 by the 2nd substrate lift style, and it will be extracted upwards. Two or more substrates W extracted from the common boat 22 are grasped by the zipper 20 of a substrate and a common boat transfer robot, are transported to a cassette taking-out ON position, and are collectively inserted by the 2nd substrate lift style into the cassette 16 of the empty placed by the cassette taking-out ON position. And the cassette 16 which accommodated two or more substrates W after heat treatment is taken out from an automatic loader and unloader and the substrate transfer part 10.

[0029]It replaces with washing and the drying treatment part 12 of composition as shown in drawing 1, and may be made to provide washing and the drying treatment part of composition as shown in drawing 8. Washing and the drying treatment part 110 shown in drawing 8 are provided with a cleaning tank, an overflow liquid holder part, a substrate lift style, a feed line, a drainage-tube way, etc. like washing and the drying treatment part 12 shown in drawing 1.

Since those composition is the same as the device shown in drawing 1, the explanation is omitted.

It is constituted by this washing and drying treatment part 110 so that the cleaning tank 54 and the whole overflow liquid holder part 56 may be surrounded by the sealing cleaning chambers 112, and in the upper part of the sealing cleaning chambers 112. The opening 114 for carrying out taking-out ON of the substrate W is formed, and it has the opening and closing cover 116 which seals the opening 114 enabling free opening and closing. And while the overheated steam blow-off part 118 which distributes the overheated steam 122 uniformly and blows off horizontally to the headroom of the cleaning tank 54 is allocated in the one side face of the sealing cleaning chambers 112 in this washing and drying treatment part 110, The overheated steam blow-off part 118 of the sealing cleaning chambers 112 and the overheated steam suction part 120 which attracts the overheated steam 122 which blew off from the overheated steam blow-off part 118 on the side which counters are allocated. Channel connection of the overheated steam blow-off part 118 is made at the overheated steam supply source.

Overheated steam is fed into the overheated steam blow-off part 118 from an overheated steam supply source, and the overheated steam 122 with a temperature of about 135–150 \*\* blows off from the overheated steam blow-off part 118, for example.

Channel connection of the vacuum pump is made for the exhaust port of the overheated steam suction part 120, and evacuation of the inside of the sealing cleaning chambers 112 is carried out, and it may enable it to decompress it through the overheated steam suction part 120.

[0030]In washing and the drying treatment part 110 as shown in drawing 8. If the overheated steam 122 is supplied to the substrate W which washing processing was carried out into the cleaning tank 54, and rinsing treatment was eventually carried out, and was able to be pulled up out of pure water, while the skin temperature of the substrate W will rise gradually, On the surface of the substrate W, the overheated steam 122 is cooled, it dews, and the whole surface of the substrate W will be covered with water. And if supply of the overheated steam 122 on the substrate W surface is suspended when temperature up is carried out even to such an extent that the skin temperature of the substrate W rose to near the temperature of the overheated steam 122 and the moisture condensation on the substrate W surface decreased, Since the surface of the substrate W is heated and has become a high temperature, free moisture will evaporate promptly from the whole surface of the substrate W. Thus, the surface of the substrate W is made to dry by making temperature of the substrate W high in the state where the whole surface of the substrate W has got wet, and evaporating free moisture at a stretch, when the skin temperature of the substrate W becomes high.

[0031]

[Effect of the Invention]Since it is constituted and this invention acts, as explained above, when heat-treating a substrate using the substrate processing device concerning this invention, A substrate face does not touch the atmosphere, and since the particle attachment or gas adsorption to a substrate face do not happen, it can prevent the fall of the yield by membrane contamination, until the substrate which finished washing and a drying process out of the period of washing and the drying process of a substrate performed as a head end process of heat treatment is heat-treated. Since the automatic loader and unloader, washing and a drying treatment part, and the heat treatment part are unified, space-saving-izing and low cost-ization are attained, and conveyance of the substrate between washing down stream processing and a heat treatment process becomes unnecessary, and processing efficiency of the substrate processing device concerning this invention improves as a whole.

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[Translation done.]

**\* NOTICES \***

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

[Drawing 1]It is transverse-plane drawing of longitudinal section showing the outline composition of the substrate processing device concerning one example of this invention.

[Drawing 2]It is a flat-surface cross-sectional view of the device shown in drawing 1.

[Drawing 3]It is a figure for explaining the operation which shows one example of the composition of the zipper of the substrate and common boat transfer robot which showed drawing 1, and which is one of the components of a device, and holds two or more substrates by a zipper.

[Drawing 4]It is a figure for explaining the operation which similarly holds the common boat in which \*\* Li and two or more substrates were accommodated by a zipper.

[Drawing 5]another example of composition of a zipper is shown -- it is an abbreviation side view in part.

[Drawing 6]It is a flow chart for explaining a series of processes of performing from washing and the drying process of a substrate to heat treatment using the substrate processing device of composition of having been shown in drawing 1.

[Drawing 7]Similarly, it is a flow chart.

[Drawing 8]It is transverse-plane drawing of longitudinal section showing another example of composition of washing and the drying treatment part which is one of the components of the substrate processing device concerning this invention.

[Drawing 9]It is a flat-surface layout pattern showing one example of the outline composition of the washing station of the conventional substrate, and a thermal treatment equipment.

[Drawing 10]It is a flat-surface layout pattern showing one example of the outline composition of the conventional substrate processing device which made in-line the washing station part and the thermal-treatment-equipment part with the interface robot.

**[Description of Notations]**

10 An automatic loader and unloader and a substrate transfer part

12 and 110 Washing and drying treatment part

14 Heat treatment part

16 Cassette

20 Zipper

22 Common boat

26 Circular board

28 Substrate support stick

30 Substrate support slot

34 and 42 Holding fixture

36 and 52 Rotation horizontal pivot

38 and 48 Substrate alignment retention groove

40 and 50 Boat retention groove

44 Rod-like structure

46 End plate

54 Cleaning tank

56 Overflow liquid holder part

58 and 112 Sealing cleaning chambers  
64 Liquid feed port  
66 Feed line  
72 Chemical supply pipe way  
78 The pipeline for steam feeding  
80 Exhaust pipe way  
86 Airtight chamber  
88 Load-locks preparation room  
90 Load lock chamber  
92 Furnace body  
94 and 96 Shutter  
98 Common boat transfer robot  
118 Overheated steam blow-off part  
120 Overheated steam suction part  
122 Overheated steam

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[Translation done.]

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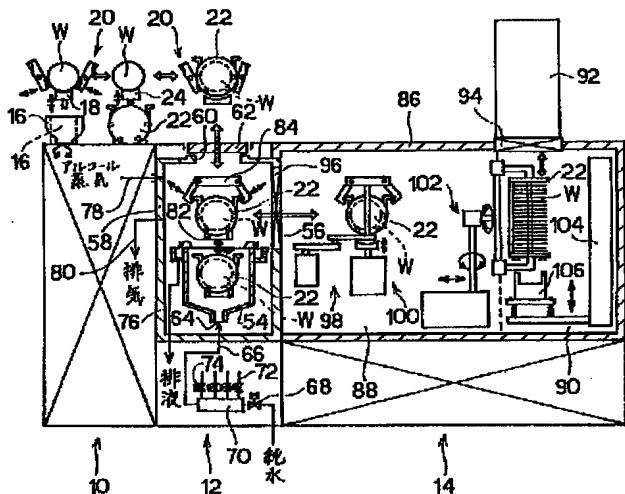
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(54)【発明の名称】 基板処理装置

(57)【要約】

【目的】 基板を熱処理する場合に、基板の洗浄・乾燥処理の期間中から基板が熱処理されるまで基板表面が大気に触れないようにし、基板表面へのパーティクル付着やガス吸着を無くして歩留りの低下を防ぐ。

【構成】 热処理部14に洗浄・乾燥処理部12を連設する。洗浄・乾燥処理部を、洗浄槽54を密閉洗浄チャンバ58で閉鎖的に包囲して構成し、洗浄槽内で洗浄処理されて純水中から引き上げられた基板Wを、密閉洗浄チャンバ内へ有機溶剤の蒸気を供給し密閉洗浄チャンバ内を減圧することにより乾燥処理する。洗浄・乾燥処理部の密閉洗浄チャンバと熱処理部の密閉チャンバ86とを、開閉自在のシャッター96を備えた連絡開口を介して連通接続し、その間で基板の移送を行なう。



## 【特許請求の範囲】

【請求項 1】 密閉チャンバ内に搬入された洗浄及び乾燥処理済みの複数枚の基板を熱処理用ポートに収容した状態で、前記密閉チャンバの内部空間とシャッターを備えた基板搬出入口を介して連通した炉体の内部へ搬入し、基板に対して所要の熱処理を施すようにした基板処理装置において、

前記密閉チャンバに、その密閉チャンバの内部空間とシャッターを備えた連絡開口を介して連通した密閉洗浄チャンバを連設し、

その密閉洗浄チャンバによって少なくとも上方空間が閉鎖的に包囲されるように、洗浄用薬液及び純水を供給するための給液口を底部に有するとともに洗浄用薬液及び純水を択一的に置換可能に収容してその薬液又は純水中に基板がそれぞれ浸漬されることにより複数種の洗浄処理及び最終リソス処理が行なわれる洗浄槽を配設し、

その洗浄槽内へ前記給液口を通して洗浄用薬液及び純水を択一的に供給する給液手段を設けるとともに、

前記密閉洗浄チャンバの内部に、前記洗浄槽の上方位置と洗浄槽内部位置との間で基板を昇降移動させる基板昇降手段を設け、

前記密閉洗浄チャンバに、その内部へ有機溶剤の蒸気を供給するための蒸気供給口を形設し、

前記密閉洗浄チャンバ内を排気して減圧する排気手段、及び、前記密閉洗浄チャンバ内へ前記蒸気供給口を通して有機溶剤の蒸気を供給する蒸気供給手段を設け、さらに、前記密閉洗浄チャンバに、洗浄前の基板を収容したカセットが搬入され、熱処理後の基板を収容したカセットの搬出が行なわれるローダ・アンローダを連設し、

そのローダ・アンローダから前記密閉洗浄チャンバ内へ洗浄前の基板を移送し、密閉洗浄チャンバ内からローダ・アンローダへ熱処理後の基板を移送する第1の基板移送手段、及び、洗浄及び乾燥処理後の基板を前記密閉洗浄チャンバ内から前記連絡開口を通じて前記密閉洗浄チャンバ内へ移送し、熱処理後の基板を密閉チャンバ内から連絡開口を通じて密閉洗浄チャンバ内へ移送する第2の基板移送手段を設けたことを特徴とする基板処理装置。

【請求項 2】 密閉チャンバ内に搬入された洗浄及び乾燥処理済みの複数枚の基板を熱処理用ポートに収容した状態で、前記密閉チャンバの内部空間とシャッターを備えた基板搬出入口を介して連通した炉体の内部へ搬入し、基板に対して所要の熱処理を施すようにした基板処理装置において、

前記密閉チャンバに、その密閉チャンバの内部空間とシャッターを備えた連絡開口を介して連通した密閉洗浄チャンバを連設し、

その密閉洗浄チャンバによって少なくとも上方空間が閉鎖的に包囲されるように、洗浄用薬液及び純水を供給するための給液口を底部に有するとともに洗浄用薬液及び

純水を択一的に置換可能に収容してその薬液又は純水中に基板がそれぞれ浸漬されることにより複数種の洗浄処理及び最終リソス処理が行なわれる洗浄槽を配設し、その洗浄槽内へ前記給液口を通して洗浄用薬液及び純水を択一的に供給する給液手段を設けるとともに、前記密閉洗浄チャンバの内部に、前記洗浄槽の上方位置と洗浄槽内部位置との間で基板を昇降移動させる基板昇降手段を設け、前記密閉洗浄チャンバに、過熱蒸気を均一に分散させて前記洗浄槽の上方空間へ水平方向に吹き出す過熱蒸気吹出し部、及び、過熱蒸気吹出し部から吹き出された過熱蒸気を吸引する過熱蒸気吸引部を設け、さらに、前記密閉洗浄チャンバに、洗浄前の基板を収容したカセットが搬入され、熱処理後の基板を収容したカセットの搬出が行なわれるローダ・アンローダを連設し、そのローダ・アンローダから前記密閉洗浄チャンバ内へ洗浄前の基板を移送し、密閉洗浄チャンバ内からローダ・アンローダへ熱処理後の基板を移送する第1の基板移送手段、及び、洗浄及び乾燥処理後の基板を前記密閉洗浄チャンバ内から前記連絡開口を通じて前記密閉洗浄チャンバ内へ移送し、熱処理後の基板を密閉チャンバ内から連絡開口を通じて密閉洗浄チャンバ内へ移送する第2の基板移送手段を設けたことを特徴とする基板処理装置。

【請求項 3】 热処理用ポートが、基板より大きい一对の円形板を互いに平行に間隔をあけて対向させ、それら両円形板を、その円形板に沿った一方側から基板を挿入可能にかつ挿入された複数枚の基板をそれぞれ互いに平行に僅かな間隔をあけて支持可能に、複数本の基板支持棒で連結して構成され、その熱処理用ポートが、洗浄及び乾燥処理にも使用する共用ポートとされた請求項1ないし請求項2のいずれかに記載の基板処理装置。

【請求項 4】 第1の基板移送手段が、板状体の板面に、溝底面が基板の周縁形状に沿った円弧状をなす基板整列保持溝を複数本、それぞれ互いに平行に熱処理用ポートにおける基板支持間隔に対応する間隔をあけ長手方向に並列させて形成するとともに、それら複数本の基板整列保持溝の列の両側に、溝底面が熱処理用ポートの円形板の周縁形状に沿った円弧状をなすポート保持溝を、それぞれ互いに平行に熱処理用ポートにおける一对の円形板同士の間隔に対応する間隔をあけ基板整列保持溝に並列させてそれぞれ形成し、その板状体を、その長手方向に沿った回転水平支軸を介して片持ち式に支持してなり、前記回転水平支軸を回転させることにより搖動される保持具を一对、水平面内において互いに平行に配設したチャックを備えて構成された請求項3記載の基板処理装置。

【発明の詳細な説明】

【0001】

**【産業上の利用分野】**この発明は、半導体デバイス製造プロセス、液晶ディスプレイ製造プロセス、電子部品関連製造プロセスなどにおいて、シリコンウエハ、ガラス基板、電子部品等の各種基板に対し酸化、CVD、拡散等の熱処理を施す基板処理装置に関する。

**【0002】**

**【従来の技術】**シリコンウエハ等の基板を酸化処理、CVD処理等の熱処理する場合、その熱処理前に基板の洗浄処理が行なわれるが、従来、基板の洗浄装置は、基板の熱処理装置とは全く別の装置として工場内の別のエリアに設置されていた。そして、洗浄装置において各種薬液で洗浄処理され最終的に純水でリーン処理された後乾燥処理された基板は、大気雰囲気下で洗浄装置から払い出され、その後に、ロボットや搬送装置或いはオペレータによって洗浄エリアから熱処理エリアへ大気雰囲気下で運搬され、熱処理装置へ搬入されていた。

**【0003】**図9は、従来の基板の洗浄装置及び熱処理装置の概略構成の1例を示す平面レイアウト図である。洗浄装置Aは、所要の洗浄用薬液を収容し、その薬液中に基板を浸漬させることにより基板に対し所要の洗浄処理を施す1つ又は複数、図示例のものは3つの薬液洗浄槽1、2、3、純水を収容し、その純水中に基板を浸漬させて基板を純水で洗浄する1つ又は複数、図示例のものは3つの純水洗浄槽1、2、3、純水を用いて最終的に基板をリーン処理する最終リーン槽、及び、最終リーン処理された基板の表面を乾燥させる乾燥処理部を連設し、薬液洗浄槽1に隣接して、洗浄前の基板を複数枚収容して搬入されてきたカセットを載置しておくローダを設けるとともに、乾燥処理部に隣接して、洗浄及び乾燥処理を終えた基板を収容したカセットを載置しそのカセットの搬出が行なわれるアンローダを設け、ローダ、薬液洗浄槽、純水洗浄槽、最終リーン槽、乾燥処理部及びアンローダの各間での基板の搬送を行なう基板搬送ロボット、及び、空のカセットをローダからアンローダへ移送するためのカセットトラックなどを備えて構成されている。それぞれの薬液洗浄槽には、例えば、薬液洗浄槽1にはアンモニア水及び過酸化水素水の混合溶液が、薬液洗浄槽2にはフッ酸が、薬液洗浄槽3には塩酸及び過酸化水素水の混合溶液が入っている。また、乾燥処理部に設置される基板の乾燥処理装置としては、遠心力によって基板の表面から純水を振り切って乾燥させるスピンドライヤや、基板の表面に付着した純水をイソプロピルアルコール等の有機溶剤の蒸気で置換することによって乾燥させる有機溶剤蒸気乾燥装置が使用される。また、アンローダに隣接してストッカーが設けられており、アンローダから搬出された、洗浄済みの基板を収容したカセットを一時的に収納してバッファ的な役割をそのストッカーが果たすことができるようになっている。一方、熱処理装置Bには、基板の熱処理が行なわれる炉体内部への大気成分の混入や基板の移送途中における大気成分

による酸化等の影響を防止するために、炉体の搬出入口に連接してロードロック室が設けられている。また、基板の搬入・搬出が行なわれるローダ・アンローダに隣接してストッカーが設けられており、洗浄装置部Aから運搬されてきた、基板を収容したカセットを一時的に収納しておくことができるようになっている。そして、洗浄装置Aから熱処理装置Bへの基板の運搬は、大気雰囲気下において行なわれることになる。

**【0004】**また、特別な例として、従来、図10に装置の概略平面レイアウト図を示すように、洗浄装置部Cと熱処理装置部DとをインターフェイスロボットEによってインライン化し、洗浄処理から熱処理まで行なえる基板処理装置として一体構成することもあった。

**【0005】**

**【発明が解決しようとする課題】**図9に示したように洗浄装置Aと熱処理装置Bとをそれぞれ別のエリアに設置するようにした場合には、洗浄装置Aにおいて洗浄及び乾燥処理されカセットに収容された基板は、洗浄装置Aから払い出されてストッカーに一時的に収納され、洗浄エリアから熱処理エリアへ運ばれ、熱処理装置Bのストッカーに収納されて熱処理の順番を待つ間中、表面が大気に曝された状態になる。また、洗浄装置A内においても、基板は、各槽間を搬送されている途中や乾燥処理部での乾燥処理中に大気の影響を受けていた。

**【0006】**また、図10に示したように洗浄装置部Cと熱処理装置部DとをインターフェイスロボットEによってインライン化した基板処理装置では、洗浄・乾燥工程と熱処理工程との間での基板搬送に要する時間や熱処理までの待ち時間を極少に抑えることができる。しかしながら、インターフェイスロボットがカセットに収容された基板を搬送している間、基板はやはり大気に曝されることになり、また、洗浄装置部C内においては、図9に示した装置と同様、基板は大気の影響を受けることになる。

**【0007】**以上の通り、従来の構成の装置では、基板に対する大気の影響を排除することはできず、このため、基板表面へのパーティクルの付着やガスの吸着が起こってカーボンや重金属などによる汚染が発生したり、酸化膜が成長したりしていた。この結果、熱処理工程、例えば酸化工程やCVD工程において基板表面に形成された膜の性質が悪くなったり、IC等の不良が発生し歩留りが低下する、といった問題点がある。

**【0008】**この発明は、以上のような事情に鑑みてなされたものであり、基板を熱処理する場合に、その前処理工程として行なわれる基板の洗浄・乾燥処理の期間中から洗浄・乾燥処理を終えた基板が熱処理されるまで、基板表面が大気に触れないようにして、基板表面へのパーティクル付着やガス吸着を無くし、膜汚染による歩留りの低下を防ぐことができる基板処理装置を提供することを目的とする。

## 【0009】

【課題を解決するための手段】この発明では、洗浄及び乾燥処理済みの複数枚の基板を収容した熱処理用ポートが搬入され、その搬入された熱処理用ポートを炉体内へ搬入するためにその熱処理用ポートの移送が行なわれる密閉チャンバに、その密閉チャンバの内部空間とシャッターを備えた連絡開口を介して連通した密閉洗浄チャンバを連設し、さらに、その密閉洗浄チャンバに、洗浄前の基板を収容したカセットが搬入され、熱処理後の基板を収容したカセットの搬出が行なわれるローダ・アンローダを連設するようにした。そして、洗浄用薬液及び純水を供給するための給液口を底部に有するとともに洗浄用薬液及び純水を逐一的に置換可能に収容してその薬液又は純水中に基板がそれぞれ浸漬されることにより複数種の洗浄処理及び最終リーン処理が行なわれる洗浄槽を、少なくともその上方空間が前記密閉洗浄チャンバによって閉鎖的に包囲されるように配設し、その洗浄槽内へ前記給液口を通して洗浄用薬液及び純水を逐一的に供給する給液手段、及び、密閉洗浄チャンバの内部において前記洗浄槽の上方位置と洗浄槽内部位置との間で基板を昇降移動させる基板昇降手段をそれぞれ設けた。また、第1の構成として、前記密閉洗浄チャンバに、その内部へ有機溶剤の蒸気を供給するための蒸気供給口を形設し、前記密閉洗浄チャンバ内を排気して減圧する排気手段、及び、前記密閉洗浄チャンバ内へ前記蒸気供給口を通して有機溶剤の蒸気を供給する蒸気供給手段をそれぞれ設け、第2の構成として、前記密閉洗浄チャンバに、過熱蒸気を均一に分散させて前記洗浄槽の上方空間へ水平方向に吹き出す過熱蒸気吹出し部、及び、過熱蒸気吹出し部から吹き出された過熱蒸気を吸引する過熱蒸気吸引部を設けた。さらに、前記ローダ・アンローダから前記密閉洗浄チャンバ内へ洗浄前の基板を移送し、密閉洗浄チャンバ内からローダ・アンローダへ熱処理後の基板を移送する第1の基板移送手段、及び、洗浄及び乾燥処理後の基板を前記密閉洗浄チャンバ内から前記連絡開口を通じて前記密閉洗浄チャンバ内へ移送し、熱処理後の基板を密閉洗浄チャンバ内から連絡開口を通じて密閉洗浄チャンバ内へ移送する第2の基板移送手段をそれぞれ設けるようにした。

【0010】また、熱処理用ポートを、基板より大きい一对の円形板を互いに平行に間隔をあけて対向させ、それら両円形板を、その円形板に沿った一方側から基板を挿入可能にかつ挿入された複数枚の基板をそれぞれ互いに平行に僅かな間隔をあけて支持可能に、複数本の基板支持棒で連結して構成し、その熱処理用ポートを、洗浄及び乾燥処理にも使用する共用ポートとすることができる。この場合に、上記した第1の基板移送手段を、板状体の板面に、溝底面が基板の周縁形状に沿った円弧状をなす基板整列保持溝を複数本、それぞれ互いに平行に熱処理用ポートにおける基板支持間隔に対応する間隔をあ

け長手方向に並列させて形成するとともに、それら複数本の基板整列保持溝の列の両側に、溝底面が熱処理用ポートの円形板の周縁形状に沿った円弧状をなすポート保持溝を、それぞれ互いに平行に熱処理用ポートにおける一对の円形板同士の間隔に対応する間隔をあけ基板整列保持溝に並列させてそれぞれ形成し、その板状体を、その長手方向に沿った回転水平支軸を介して片持ち式に支持してなり、前記回転水平支軸を回転させることにより揺動される保持具を一对、水平面内において互いに平行に配設したチャックを備えて構成することができる。

## 【0011】

【作用】上記した構成の基板処理装置では、密閉洗浄チャンバによって上方空間が閉鎖的に包囲された洗浄槽内において複数種の基板の洗浄処理から最終リーン処理までが行なわれ、洗浄槽内で最終リーン処理された基板は、洗浄槽内の純水中から引き上げられ、そのまま密閉洗浄チャンバ内において、その密閉洗浄チャンバ内に有機溶剤の蒸気が供給され密閉洗浄チャンバ内部が減圧されることにより、或いは、密閉洗浄チャンバ内に過熱蒸気が供給されることにより、乾燥処理される。従って、洗浄処理から乾燥処理が終了するまでの間、基板は大気に全く触れることがない。そして、洗浄及び乾燥処理された基板は、基板移送手段により密閉洗浄チャンバ内から密閉チャンバ内へ移送され、炉体内部へ搬入されて熱処理されるが、密閉洗浄チャンバと密閉チャンバとは連通していて、密閉洗浄チャンバ内から密閉チャンバ内への基板の移送は、シャッターを備えた連絡開口を通じて行なわれる。このため、洗浄及び乾燥処理を終えた基板は、大気に触れることなく密閉チャンバ内へ移送されて熱処理されることになる。このように、基板の洗浄・乾燥処理の期間中から洗浄・乾燥処理を終えた基板が熱処理されるまでの間、基板表面は全く大気に触れないので、基板表面へのパーティクル付着やガス吸着は起こらず、大気の影響を全く受けない。

## 【0012】

【実施例】以下、この発明の好適な実施例について図面を参照しながら説明する。

【0013】図1は、この発明の1実施例に係る基板処理装置の概略構成を示す正面縦断面図であり、図2は、その平面横断面図である。この基板処理装置は、ローダ・アンローダ及び基板移し替え部10、洗浄・乾燥処理部12及び熱処理部14から構成されており、それらが一体化されている。そして、この基板処理装置により、基板の洗浄から熱処理までが行なわれることになる。

【0014】ローダ・アンローダ及び基板移し替え部10には、詳細な機構は図示していないが、処理前の基板を収容して搬入してきたカセット16を90°回転させてその向きを変えるターンテーブル、複数個の基板を鉛直姿勢で保持するための平行な複数本の保持溝が上面に形成された基板保持板18を有し、ターンテーブル上に載置

されたカセット16から処理前の複数枚の基板Wを一括して上方へ抜き出し、また、処理後の複数枚の基板を降下させてカセット16内へ一括して挿入する第1の基板昇降機構、後述するチャック20を備え、基板Wをカセット16の搬出入位置と基板移し替え位置との間で移送し、複数枚の基板Wが挿入された共用ポート22を基板移し替え位置と洗浄・乾燥処理部12との間で移送する基板・共用ポート移送ロボット、複数枚の基板を鉛直姿勢で保持するための平行な複数本の保持溝が上面に形成された基板保持板24を有し、処理前の複数枚の基板Wを降下させて基板移し替え位置に置かれた共用ポート22内へ一括して挿入し、また、処理後の複数枚の基板を共用ポート22から一括して抜き出す第2の基板昇降機構。また、共用ポートを基板共用ポート移送ロボットとの取り合い点まで昇降可能なポート昇降機構等が設けられている。

**【0015】**共用ポート22は、図4に示すように、基板Wより大きい一对の円形板26、26を互いに平行に間隔をあけて対向させ、それら両円形板26、26を複数本、図示例では4本の基板支持棒28で連結して構成されている。各基板支持棒28の両端部は、各円形板26の周縁部にそれぞれ固着し、また、4本の基板支持棒28は、円形板26の半周部分に固着するようにして、円形板26に沿った一方から基板Wを挿入することができるようになっている。また、各基板支持棒28には、複数枚の基板Wをそれぞれ互いに平行に僅かな間隔をあけて支持するための複数本の基板支持溝30が形成されている。さらに、両円形板26にはそれぞれ、水平姿勢の共用ポート22を吊り下げるための一対の引掛け爪32、32が固着されている。この共用ポート22は、例えば石英材料で形成され、複数枚の基板Wを収容して洗浄及び乾燥処理工程と熱処理工程との両方に使用される。

**【0016】**基板・共用ポート移送ロボットのチャック20は、図3及び図4に示すように、板状体を、その長手方向に沿った回転水平支軸36を介して片持ち式に支持してなる保持具34を一对、水平面内において互いに平行に配設して構成されている。一对の保持具34は、水平軸回りに揺動自在に支持されており、回転水平支軸36に連結した駆動機構(図示せず)によって回転水平支軸36を回動させることにより、互いに対称的に揺動するようになっている。各保持具34には対向した片面側にそれぞれ、溝底面が基板Wの周縁形状に沿った円弧状をなす基板整列保持溝38が複数本、それぞれ互いに平行に、共用ポート22の基板支持棒28の基板支持溝30と同一ピッチ間隔で、長手方向に並列して形成されているとともに、それら複数本の基板整列保持溝38の列の両側であって長手方向における両端部に、溝底面が共用ポート22の円形板26の周縁形状に沿った円弧状をなす一对のポート保持溝40が、それぞれ互いに平行に、共用ポート22の一対の円形板26、26間の距離に対応する間隔をあけて形成されている。そして、チャック20は、カセット搬出入位置と基板

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移し替え位置との間、並びに、基板移し替え位置と洗浄・乾燥処理部12との間をそれぞれ往復移動自在とされている。

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**【0017】**上記のように構成されたチャック20を備えた基板・共用ポート移送ロボットによりカセット搬出入位置と基板移し替え位置との間で基板Wを移送する場合には、図3の(a)に斜視図を、(b)に保持具34の長手方向と直交する方向に切断した断面図を、(c)に保持具34の長手方向に沿って切断した部分拡大断面図をそれぞれ示したように、チャック20の一対の保持具34の各基板整列保持溝38内に各基板Wの周縁部の一部がそれぞれ挿入されるように、チャック20の一対の保持具34によって複数枚の基板Wを一括して保持する。一方、基板・共用ポート移送ロボットにより基板移し替え位置と洗浄・乾燥処理部12との間で基板Wを移送する場合には、図4の(a)に斜視図を、(b)に保持具34の長手方向と直交する方向に切断した断面図を、(c)に保持具34の長手方向に沿って切断した部分拡大断面図をそれぞれ示したように、チャック20の一対の保持具34によって共用ポート22を保持する。

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**【0018】**尚、図5に示すように、互いに平行な一对の棒状体44、44の両端の各端部同士を端板46によってそれぞれ連接し、一对の棒状体44、44の一方又は両方の周面方向の全体又は一部、図示例では両方の棒状体44の周面方向の全体に、基板整列保持溝48を複数本、共用ポート22の基板支持棒28の基板支持溝30と同一ピッチ間隔で軸線方向に並列して形成するとともに、棒状体44の両端部にポート保持溝50を、共用ポート22の一対の円形板26、26間の距離に対応する間隔をあけて形成し、端板46の一方に回転水平支軸52を固着した保持具42を一对、互いに平行に配設することにより、基板・共用ポート移送ロボットのチャックを構成することもできる。これらのチャックは反対側に同様の溝を形成して、基板とポートをそれぞれに対して、洗浄前、洗浄後を使い分けてクロスコンタミネーションを防止するように構成されている。

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**【0019】**洗浄・乾燥処理部12は、洗浄槽54及びこの洗浄槽54の上部外周に設けられた溢流液受け部56を有しており、それら全体を密閉洗浄チャンバ58で包囲するように構成されている。密閉チャンバ58の上部には、基板Wを搬出入するための開口60が形設されており、その開口60を開閉自在に密閉する開閉蓋62が設けられている。洗浄槽54には、その底部に給液口64が形設されており、その給液口64は、給水管路66によって純水供給源に連通接続されている。給水管路66には、開閉弁68が介挿されているとともに、その開閉弁68と洗浄槽54の給液口64との間の流路にミキシングバルブ70が介挿されている。ミ

キシングバルブ70には、それぞれ異なる種類の洗浄用薬液の供給源にそれぞれ流路接続され開閉弁74が介挿された複数本の薬液供給管路72が連通接続されている。そして、薬液供給管路72に介挿された開閉弁74のうちの1つだけを開放するとともに給液管路66に介挿された開閉弁68を開くことにより、純水供給源から供給される純水に何れか1種類の洗浄用薬液が混合されて所要の洗浄用処理液が調合され、その洗浄用処理液が給液管路66を通り給液口64を通して洗浄槽54内へ供給される。また、薬液供給管路72に介挿された開閉弁74を全て閉塞するとともに給液管路66に介挿された開閉弁68を開くことにより、純水供給源から給液管路66を通じて洗浄槽54内へ純水が供給されるようになっている。また、溢流液受け部56には排液管路76が接続されている。そして、洗浄槽54では、給液口64を通じ連続して槽内へ洗浄用処理液が供給され、槽上部の越流部から処理液を溢れ出させることにより、槽内部において処理液の上昇液流が形成され、その処理液の上昇液流中に基板Wが置かれることにより基板Wが洗浄処理される。

【0020】密閉洗浄チャンバ58には、有機溶剤の蒸気、例えばイソプロピルアルコールの蒸気を密閉洗浄チャンバ58内へ供給するための蒸気供給口が形設されており、その蒸気供給口に蒸気供給用管路78を介してアルコール蒸気供給源が流路接続されている。尚、図1には図示していないが、蒸気供給用管路78は窒素供給源に流路接続されており、窒素ガスをキャリヤガスとしてアルコール蒸気が密閉洗浄チャンバ58内へ送給されるとともに、流路の切換えにより蒸気供給用管路78を通して窒素ガスだけを密閉洗浄チャンバ58内へ送り込んで密閉洗浄チャンバ58の内部をペーパーすることができる構成となっている。さらに、密閉洗浄チャンバ58には排気口が形設されており、排気口は排気管路80を介して排気手段、例えば水封式真空ポンプに流路接続されていて、その排気口を通して密閉洗浄チャンバ58内を真空ポンプで排気することにより、密閉洗浄チャンバ58内を減圧することができる。また、図示を省略しているが、密閉洗浄チャンバ58の内部には、保持部82に共用ポート22を保持して昇降させる基板昇降機構が設けられており、この基板昇降機構により、共用ポート22に収容された基板Wを洗浄槽54の上方位置と洗浄槽54内部位置との間で昇降移動させることができるようになっている。さらに、密閉洗浄チャンバ58の内部には、基板・共用ポート移送ロボットのチャック20から共用ポート22を受け取って基板昇降機構の保持部82へ移載する共用ポート移載ロボット84が配設されている。

【0021】一方、熱処理部14は、密閉チャンバ86を備え、密閉チャンバ86の内部がロードロック準備室88とロードロック室90とに分かれ、ロードロック室90が、開閉自在のシャッター94を備えた基板搬出入口を介して炉体92と連通接続している。そして、ロードロック準備室88

と洗浄・乾燥処理部12の密閉洗浄チャンバ58とが、開閉自在のシャッター96を備えた連絡開口を介して気密に連通接続している。ロードロック準備室88内には、共用ポート移送ロボット98が配設されており、この共用ポート移送ロボット98により、洗浄・乾燥処理部12で最終リーンス及び乾燥処理を終えた複数枚の基板Wを収容した共用ポート22を密閉洗浄チャンバ58内から連絡開口を通じてロードロック準備室88内へ移送する。また、ロードロック準備室88内には、共用ポート移送ロボット98から共用ポート22を受け取って共用ポート22を一時的に載置しておく一時載置ステージ100が配設されている。さらに、ロードロック準備室88内には、共用ポート移載ロボット102が設けられており、この共用ポート移載ロボット102により、基板Wを収容した共用ポート22を、ロードロック室90内に配設されたエレベータ104に昇降自在に保持された共用ポート支持具兼密閉蓋106上へ移し替えるようになっている。そして、エレベータ104は、共用ポート支持具兼密閉蓋106上に支持された共用ポート22に収容された基板Wを、基板搬出入口を通して炉体92内へ挿入し、また、炉体92内で所要の熱処理、例えば減圧CVD処理された後の基板を炉体92内から搬出する。また、密閉チャンバ86には、排気口が形設されており、排気口は排気手段、例えば真空ポンプに流路接続されていて、その排気口を通して密閉チャンバ86内を真空ポンプで排気することにより、密閉チャンバ86内を減圧することができる。尚、図示した炉体92は縦型タイプであるが、横型タイプの炉体でもよい。また、処理速度を上げるためにロードロック準備室88とロードロック室90を別のシャッターで仕切って、それぞれ別の排気手段で排気することによって排気時間を短縮することが出来る。

【0022】次に、上記した構成の基板処理装置を使用して基板の洗浄・乾燥処理から熱処理までを行なう一連の工程について、図6及び図7に示したフローチャートを参照しながら説明する。

【0023】処理前の複数枚の基板Wを収容したカセット16がローダ・アンローダ及び基板移し替え部10に搬入されて載置されると、第1の基板昇降機構により、カセット16から基板Wが一括して上方へ抜き出され、それら複数枚の基板Wは、基板・共用ポート移送ロボットのチャック20に把持され、基板・共用ポート移送ロボットによって基板移し替え位置へ移送された後、第2の基板昇降機構により、基板移し替え位置に置かれた共用ポート22内へ一括して挿入される。共用ポート22内に基板Wが収容されると、共用ポート22は、洗浄・乾燥処理部12へ移送され、密閉洗浄チャンバ58の開閉蓋62が開放された後、開口60を通じて密閉洗浄チャンバ58内へ搬入され、基板昇降機構の保持部82へ移載される。そして、開閉蓋62が閉じられて密閉洗浄チャンバ58内が密閉されると、真空ポンプにより密閉洗浄チャンバ58内が真空排気されて減圧ペーパーされ、或いは、密閉洗浄チャンバ58内へ蒸

気供給用管路78を通して窒素ガスが送り込まれて密閉洗浄チャンバ58内がガスバージされる。このとき、洗浄槽54内には、その底部の給液口64を通して所要の洗浄用処理液が連続して供給され、洗浄槽54内部を満たした処理液は、その上部の越流部から溢れ出て溢流液受け部56内へ流入し、溢流液受け部56から排液管路76を通って排液されており、洗浄槽54の内部に処理液の上昇液流が形成されている。次に、基板昇降機構が作動して、保持部82に保持された共用ポート22が下降し、共用ポート22に収容された基板Wが洗浄槽54内の処理液中に浸漬させられ、洗浄槽54内の処理液の上昇液流中に基板Wが置かされることにより、基板Wに対し所要の洗浄処理が行なわれる。そして、洗浄槽54内に基板Wを配置したまま、その洗浄槽54内へ供給される洗浄用処理液の種類を変えることにより、基板Wに対し複数種の洗浄処理が施され、最終的に純水で基板Wに対しリンス処理が施される。最終的にリンス処理された基板Wは、基板昇降機構によって上昇させられ、洗浄槽54内の純水中から引き上げられる。そして、純水中から基板Wが引き上げ始められるのと同時に、蒸気供給用管路78を通して密閉洗浄チャンバ58内へ蒸気供給口からアルコール蒸気が送り込まれ、純水中から引き上げられている途中の基板Wの周囲へアルコール蒸気が供給される。このアルコール蒸気の供給は、少なくとも純水中からの基板Wの引上げが完全に終了するまで行なわれる。純水中からの基板Wの引上げが終了すると、洗浄槽54内への純水の供給を停止させ、同時に、洗浄槽54内の純水を排出する。また、洗浄槽54から純水を排出し始めるのと同時に、真空ポンプにより密閉洗浄チャンバ58内が真空排気されて、密閉洗浄チャンバ58内が減圧状態にされることにより、基板Wの表面に凝縮して純水と置換したアルコールが蒸発させられ、基板Wの乾燥処理が終了する。

**【0024】**以上のように、洗浄・乾燥処理部12では、基板Wは、洗浄処理され最終リンス処理されてから乾燥処理が終了するまでの間、密閉された密閉洗浄チャンバ58内において処理され、大気に全く触れることがないので、その間に基板Wの表面にパーティクルが付着したり炭酸ガス、酸素等のガスが吸着したりすることがない。

**【0025】**洗浄・乾燥処理部12での基板Wの乾燥処理が終了すると、連絡開口のシャッター96が開放され、共用ポート移送ロボット98により、複数枚の基板Wを収容した共用ポート22が密閉洗浄チャンバ58内から連絡開口を通ってロードロック準備室88内へ移送される。このとき、必要に応じ、共用ポート22を密閉洗浄チャンバ58内からロードロック準備室88内へ移送する前に、連絡開口のシャッター96を閉塞した状態で、熱処理部14の密閉チャンバ86内を真空排気し、ロードロック室90及びロードロック準備室88の内部を洗浄・乾燥処理部12の密閉洗浄チャンバ58の内部と同じ圧力になるまで減圧しておくようとする。また、洗浄・乾燥処理部12での基板Wの乾燥

処理が終了した後、密閉洗浄チャンバ58内を窒素ガスによってバージし、密閉洗浄チャンバ58内を減圧下から大気圧下へ戻した後、熱処理部14のロードロック準備室88内への基板Wの移送を行なうようにしてもよい。この場合には、熱処理部14の密閉チャンバ86内を真空排気してロードロック室90及びロードロック準備室88の内部を減圧する代わりに、密閉チャンバ86内へ窒素ガスを供給する手段を設けておき、連絡開口のシャッター96を閉塞した状態で、熱処理部14の密閉チャンバ86内へ窒素ガスを送り込んで密閉チャンバ86の内部をバージしておいた後、連絡開口のシャッター96を開放して、基板Wを収容した共用ポート22を洗浄・乾燥処理部12の密閉洗浄チャンバ58内からロードロック準備室88内へ移送するようとする。

**【0026】**複数枚の基板Wを収容した共用ポート22がロードロック準備室88内へ移送されると、連絡開口のシャッター96が閉塞される。次に、共用ポート22は、共用ポート移送ロボット98から一時載置ステージ100へ移載され、次いで、共用ポート移載ロボット102により、基板Wを収容した共用ポート22が、エレベータ104に昇降自在に保持された共用ポート支持具兼密閉蓋106上へ移し替えられる。この一連の操作と併行して、ロードロック室90内が減圧バージ又は窒素ガスバージされ、ロードロック室90の内部が炉体92の内部圧力と同じ圧力になるよう調節される。ロードロック室90の内部が炉体92の内部圧力と同じ圧力になると、炉体92の基板搬出入口のシャッター94が開放され、エレベータ104により、共用ポート支持具兼密閉蓋106上に支持された共用ポート22に収容された基板Wが、基板搬出入口を通って炉体92内へ搬入される。基板Wが炉体92内へ搬入されると、炉体92の基板搬出入口のシャッター94が閉塞され、炉体92内において基板Wに対し所要の熱処理、例えば減圧CVD処理が施される。

**【0027】**以上のように、この基板処理装置では、洗浄・乾燥処理部12において洗浄及び最終リンス処理され乾燥処理された基板Wは、大気に触れることなく熱処理部14のロードロック準備室88内へ移送されるので、その移送の間に、基板表面にパーティクルが付着したり炭酸ガス・酸素等のガスが吸着したりすることがない。

**【0028】**炉体92内における基板の熱処理が終了すると、炉体92の基板搬出入口のシャッター94が再び開放され、エレベータ104が駆動されて、共用ポート支持具兼密閉蓋106上に支持された共用ポート22に収容され熱処理を終えた基板が炉体92内から基板搬出入口を通って搬出される。炉体92内からの基板の搬出が終わると、炉体92の基板搬出入口のシャッター94は再び閉塞される。続いて、熱処理後の基板を収容した共用ポート22は、共用ポート移載ロボット102により、共用ポート支持具兼密閉蓋106上から一時載置ステージ100上へ移載され、次いで、共用ポート移送ロボット98に移し替えられ、この動

作と併行して、ロードロック室90及びロードロック準備室88の内部が昇圧され或いは窒素ガスバージされる。そして、連絡開口のシャッター96が開放され、共用ポート移送ロボット98により、熱処理後の複数枚の基板Wを収容した共用ポート22がロードロック準備室88内から連絡開口を通って密閉洗浄チャンバ58内へ移送され、その後に連絡開口のシャッター96が閉塞される。連絡開口のシャッター96が閉塞されると、密閉洗浄チャンバ58の内部が昇圧され或いは窒素ガスバージされて、密閉洗浄チャンバ58内が大気圧に復帰する。密閉洗浄チャンバ58内が大気圧に戻ると、開閉蓋62が開放され、共用ポート22は、密閉洗浄チャンバ58内から開口60を通って搬出される。密閉洗浄チャンバ58内から共用ポート22が搬出されると、共用ポート22は、基板・共用ポート移送ロボットによって基板移し替え位置へ移送され、第2の基板昇降機構により共用ポート22から基板Wが一括して上方へ抜き出される。共用ポート22から抜き出された複数枚の基板Wは、基板・共用ポート移送ロボットのチャック20に把持されて、カセット搬出入位置へ移送され、第2の基板昇降機構により、カセット搬出入位置に置かれた空のカセット16内へ一括して挿入される。そして、熱処理後の複数枚の基板Wを収容したカセット16は、ローダ・アンローダ及び基板移し替え部10から搬出される。

【0029】尚、図1に示したような構成の洗浄・乾燥処理部12に代えて、図8に示すような構成の洗浄・乾燥処理部を設けるようにしてもよい。図8に示した洗浄・乾燥処理部110は、図1に示した洗浄・乾燥処理部12と同様に、洗浄槽、溢流液受け部、基板昇降機構、給液管路、排液管路などを備えており、それらの構成は、図1に示した装置と同じであるので、その説明を省略する。また、この洗浄・乾燥処理部110も、洗浄槽54及び溢流液受け部56の全体を密閉洗浄チャンバ112で包囲するよう構成されており、密閉洗浄チャンバ112の上部には、基板Wを搬出入するための開口114が設けられ、その開口114を開閉自在に密閉する開閉蓋116を有している。そして、この洗浄・乾燥処理部110では、密閉洗浄チャンバ112の一側面に、過熱蒸気122を均一に分散させて洗浄槽54の上方空間へ水平方向に吹き出す過熱蒸気吹出し部118が配設されているとともに、密閉洗浄チャンバ112の、過熱蒸気吹出し部118と対向する側面に、過熱蒸気吹出し部118から吹き出された過熱蒸気122を吸引する過熱蒸気吸引部120が配設されている。過熱蒸気吹出し部118は、過熱蒸気供給源に流路接続されており、過熱蒸気供給源から過熱蒸気吹出し部118へ過熱蒸気が送給され、過熱蒸気吹出し部118から、例えば135～150℃程度の温度の過熱蒸気122が吹き出するようになっている。尚、過熱蒸気吸引部120の排気口に真空ポンプを流路接続し、過熱蒸気吸引部120を通して密閉洗浄チャンバ112内を真空排気して減圧することができるようにもよい。

【0030】図8に示したような洗浄・乾燥処理部110では、洗浄槽54内において洗浄処理され最終的にリソルブ処理されて純水中から引き上げられた基板Wに対して過熱蒸気122が供給されると、基板Wの表面温度が次第に上昇するとともに、基板Wの表面で過熱蒸気122が冷却されて結露し、基板Wの表面全体が水で覆われた状態になる。そして、基板Wの表面温度が、過熱蒸気122の温度付近まで上昇し基板W表面上での水分凝縮が少なくなる程度にまで昇温した時に、基板W表面への過熱蒸気122の供給を停止すると、基板Wの表面は加熱されて高い温度になっているため、基板Wの表面全体から付着水分が速やかに蒸発してしまう。このように、基板Wの表面全体が濡れたままの状態で基板Wの温度を高め、基板Wの表面温度が高くなった時点で、一気に付着水分を蒸発させることにより、基板Wの表面が乾燥させされることになる。

### 【0031】

【発明の効果】この発明は以上説明したように構成されかつ作用するので、この発明に係る基板処理装置を使用して基板の熱処理を行なうときは、熱処理の前処理工程として行なわれる基板の洗浄・乾燥処理の期間中から洗浄・乾燥処理を終えた基板が熱処理されるまで、基板表面は大気に触れることがなく、基板表面へのパーティクル付着やガス吸着が起こらないため、膜汚染による歩留りの低下を防ぐことができる。また、この発明に係る基板処理装置は、ローダ・アンローダと洗浄・乾燥処理部と熱処理部とが一体化されているため、省スペース化、低コスト化が図られ、また、洗浄処理工程と熱処理工程との間での基板の運搬が不要になり、全体として処理効率が向上する。

### 【図面の簡単な説明】

【図1】この発明の1実施例に係る基板処理装置の概略構成を示す正面縦断面図である。

【図2】図1に示した装置の平面横断面図である。

【図3】図1に示した装置の構成要素の1つである基板・共用ポート移送ロボットのチャックの構成の1例を示し、チャックによって複数枚の基板を保持する動作を説明するための図である。

【図4】同じく、チャックにより、複数枚の基板を収容した共用ポートを保持する動作を説明するための図である。

【図5】チャックの別の構成例を示す一部省略側面図である。

【図6】図1に示した構成の基板処理装置を使用して基板の洗浄・乾燥処理から熱処理までを行なう一連の工程について説明するためのフローチャートである。

【図7】同じく、フローチャートである。

【図8】この発明に係る基板処理装置の構成要素の1つである洗浄・乾燥処理部の別の構成例を示す正面縦断面図である。

【図9】従来の基板の洗浄装置及び熱処理装置の概略構成の1例を示す平面レイアウト図である。

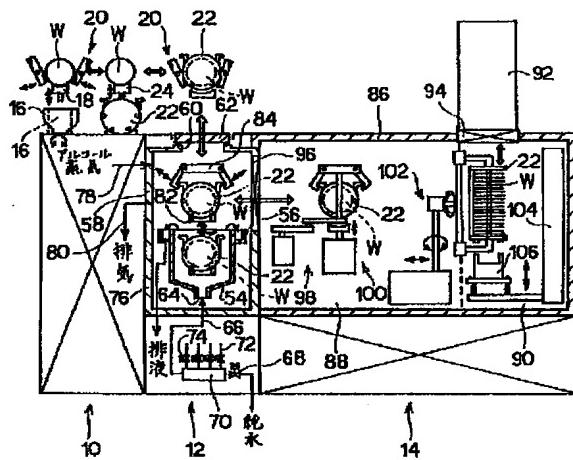
【図10】洗浄装置部と熱処理装置部とをインターフェイスロボットによってインライン化した従来の基板処理装置の概略構成の1例を示す平面レイアウト図である。

## 【符号の説明】

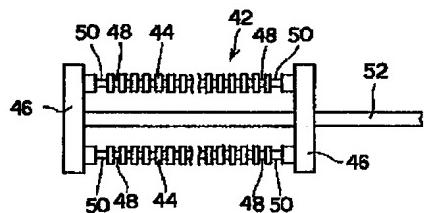
- 10 ローダ・アンローダ及び基板移し替え部
  - 12、110 洗浄・乾燥処理部
  - 14 熱処理部
  - 16 カセット
  - 20 チャック
  - 22 共用ポート
  - 26 円形板
  - 28 基板支持棒
  - 30 基板支持溝
  - 34、42 保持具
  - 36、52 回転水平支軸
  - 38、48 基板整列保持溝
  - 40、50 ポート保持溝

- \* 44 棒状体
- 46 端板
- 54 洗浄槽
- 56 溢流液受け部
- 58、112 密閉洗浄チャンバ
- 64 給液口
- 66 給液管路
- 72 薬液供給管路
- 78 蒸気供給用管路
- 80 排気管路
- 86 密閉チャンバ
- 88 ロードロック準備室
- 90 ロードロック室
- 92 炉体
- 94、96 シャッター
- 98 共用ボート移送ロボット
- 118 過熱蒸気吹出し部
- 120 過熱蒸気吸引部
- 122 過熱蒸気

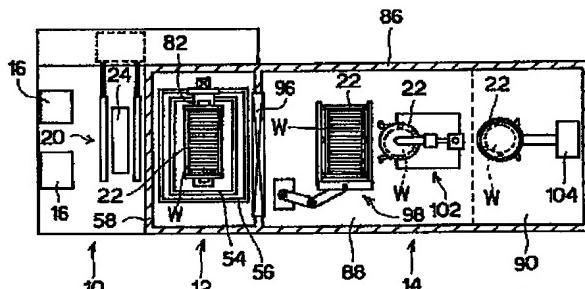
[図1]



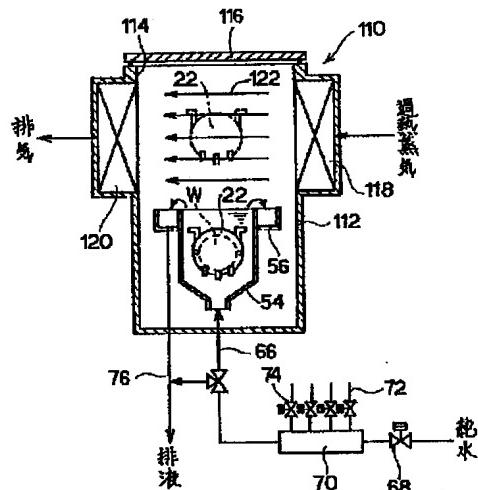
〔図5〕



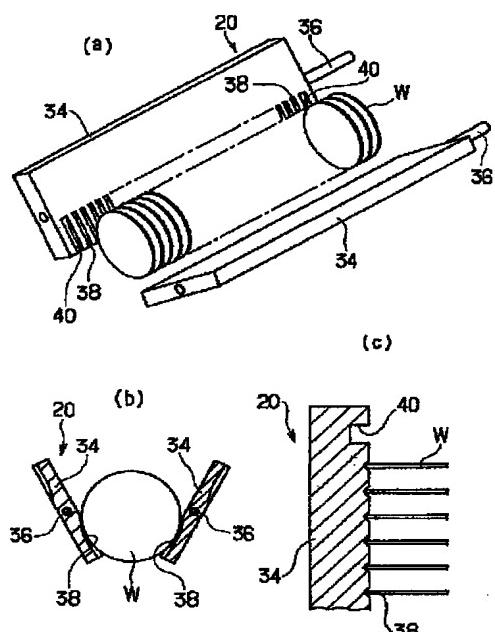
[圖 2]



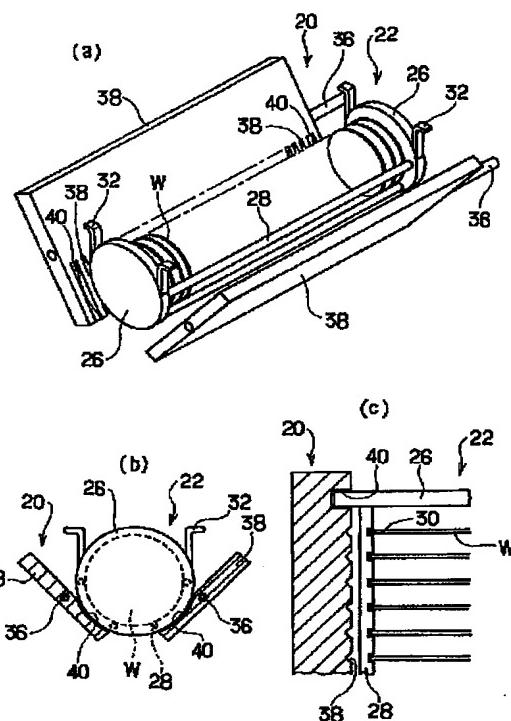
〔四八〕



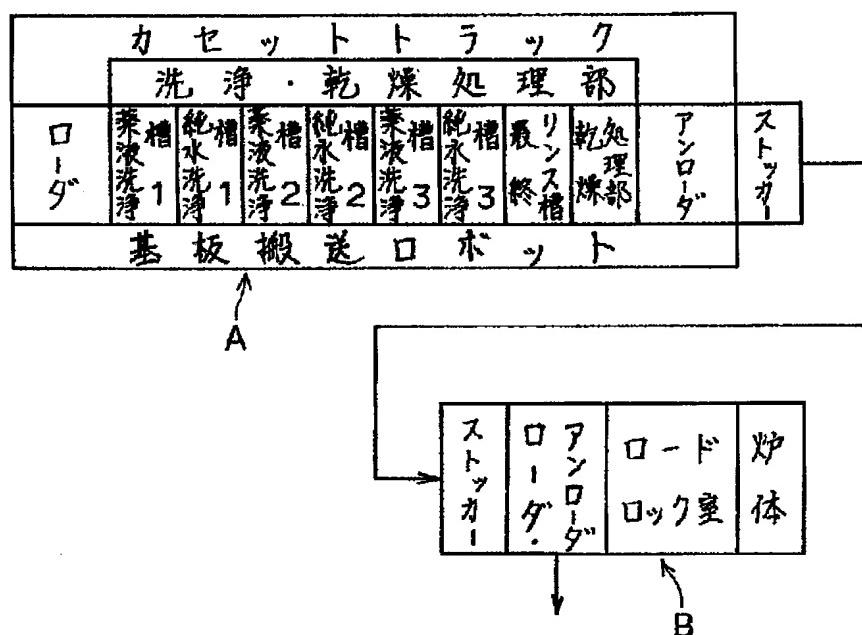
【図3】



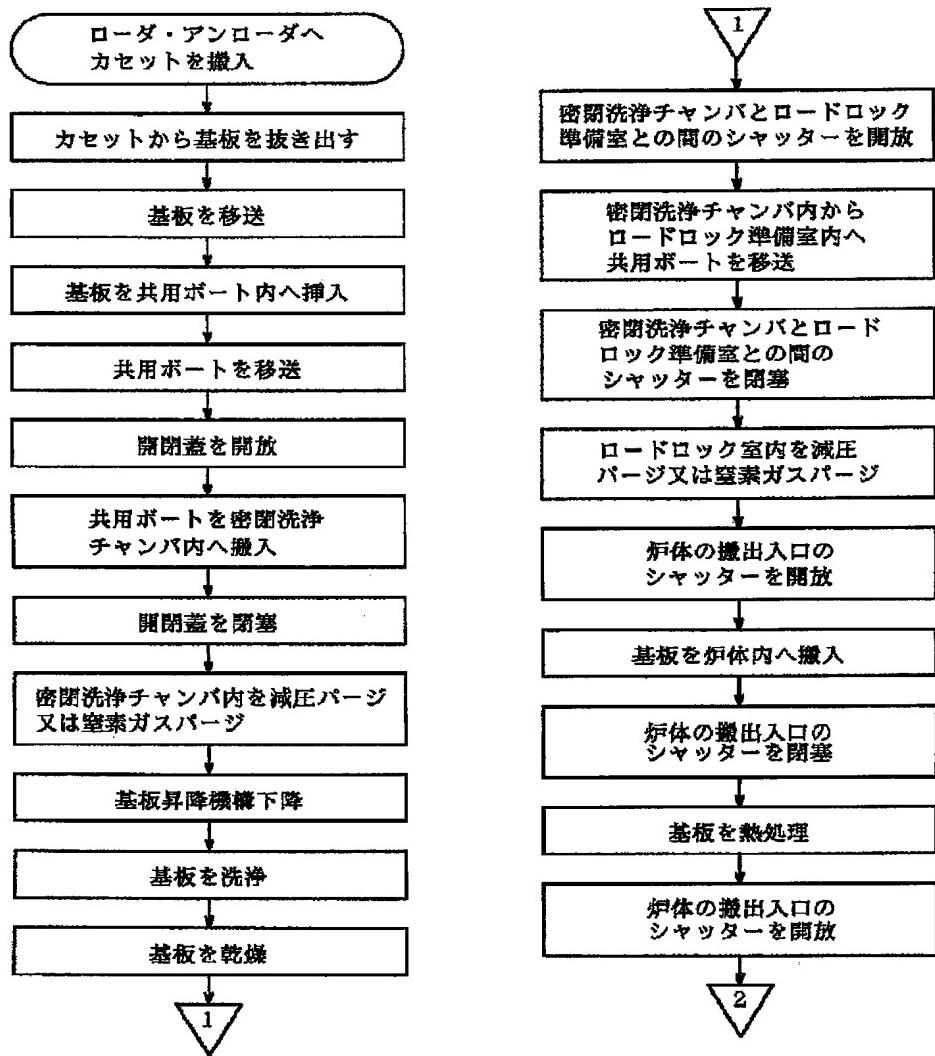
【図4】



【図9】

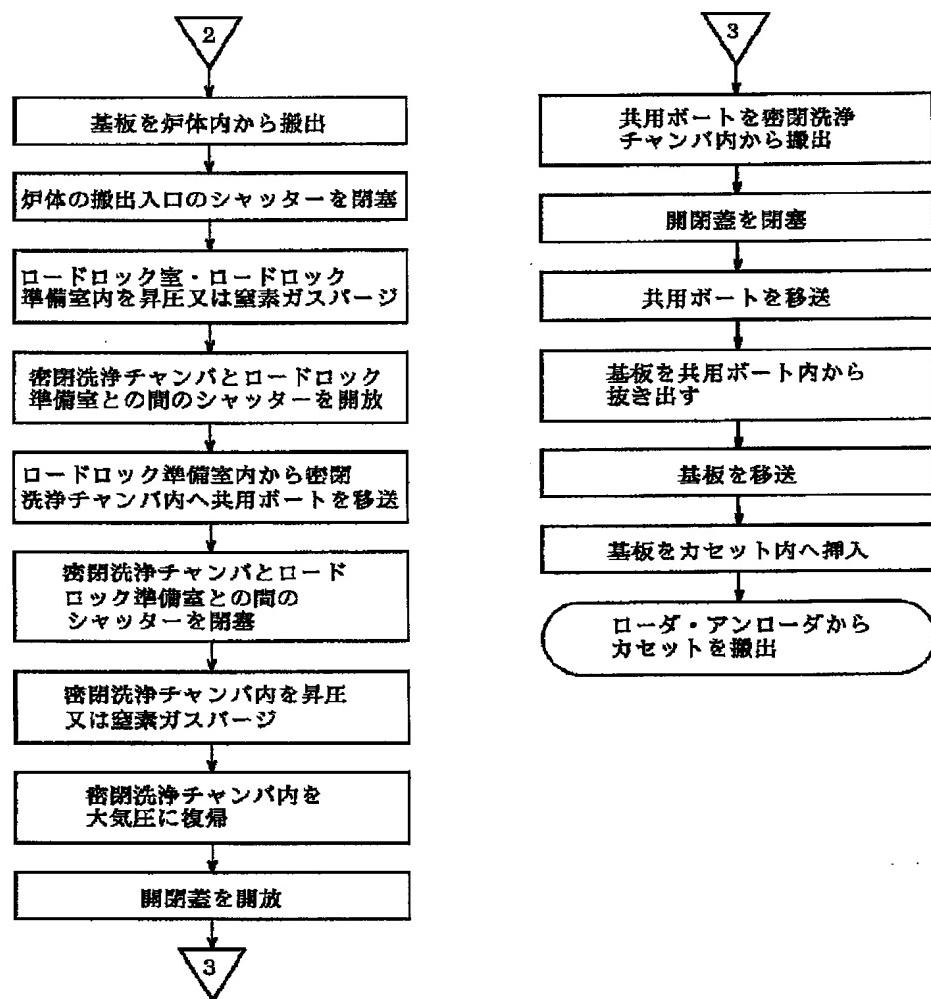


【圖 6】



【図10】

【図7】



フロントページの続き

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21/324				